BULLETIN

OF THE

Society for the Promotion of Engineering Education

Published under the supervision of the Publication Committee:

H. S. JACOBY, ANSON MARSTON, F. L. BISHOP, *Editor*.

Address all communications to the Editor, University of Pittsburgh, Pittsburgh, Pa.

VOL. VI LANCASTER, PA., JANUARY, 1916 No. 5

TABLE OF CONTENTS.

Editorials 288
The Monthly Letter 288
Letters to the Editor 289
Society Notes 290
Council Actions 293
New Members 293
Applicants for Membership 294
Books Received 294
Book Reviews 295
College Notes 295
Obituary Notice, A. J. DuBois 300
Other Societies 301
The University of Virginia 303
Economy in the Use of Class Rooms at Lafayette College, by W. T. Lyle 315
The Development of Engineering Words, by J. M. Telleen 325
The Function of A Municipal Technical School, by A. R. Cullimore. 332
Laboratory Instruction 340
Discussion on "The Economy in the Use of the Class Rooms at Lafayette College" 346
Progress Reports of Committees 348

EDITORIALS.

It is conceded that the next decade will see a very great development of the natural resources of this country, especially those parts which require for their development the applications of sciences, and scientifically and technically trained men. This development will undoubtedly be greater in the South than in any other section of the country, due not only to the natural resources but also to the rapid development of technical facilities where comparatively meager facilities have heretofore existed. The meeting of this Society at the University of Virginia will tend to a distinct growth of engineering education in the South especially in those institutions which, for many years, were devoted exclusively to classical education. This Society may contribute very materially to the progress of engineering education in the South not only by having the meeting at the University of Virginia but by bringing many new members from the district to the Society and thus placing them in contact with the marked development and trend of engineering education.

Work of the Committees of the Society.—There is published in this number of the BULLETIN a brief statement of progress of each of the committees appointed at the Ames meeting. That the various committees have taken hold of their work in an enthusiastic way is evidenced not only by these preliminary reports, but by the long list of questionnaires which the Secretary will send out very shortly. It speaks well for an enthusiastic meeting at the University of Virginia.

THE MONTHLY LETTER.

The publication in this month's number of the Treasurer's statement is by the order of the Executive Committee, and is for the express purpose of calling attention to the fact that the payment of dues on time is an important duty of the members.

President Jacoby presented a paper on "Long Span Bridges" before the Second Pan-American Scientific Congress at Washington.

The Secretary has received visits recently from President Hollis Godfrey and Dean A. J. Rowland, of Drexel Institute; President H. C. Bumpus and Dean G. C. Anthony, of Tufts College, and Professor C. F. Scott, of Sheffield Scientific School.

The year book is under way, cards having been sent to each member asking for his address and official title and also the subject under which he wishes to be classified. Certain changes will be made in the year book this year and completed next year. These changes tending to make the information contained in the book more easily available.

A special membership committee for the Virginia meeting has been appointed from representatives of the institutions in the South. The committee is as follows: W. M. Riggs, of Clemson College, Chairman, J. R. Benton, University of Florida, F. P. Anderson, of the University of Kentucky, Gustav Wittig, of the University of Alabama, T. W. Atkinson, of Louisiana State University, P. H. Daggett, of the University of North Carolina, W. W. Carson, of the University of Tennessee, E. J. Oglesby, of the University of Virginia, and W. B. Gregory, Tulane University.

LETTERS TO THE EDITOR.

TO THE EDITOR,

Dear Sir: One does not find any special difficulty in presenting a stock list of qualities essential to a good instructor. It is quite another matter to place these qualities in the order of their relative importance and no two teachers would probably arrange such a list in exactly the same way. The writer submits the following, grouping abilities under "natural" and "acquired." It is assumed that the instructor has received the necessary scholastic training and is faithful to his duties.

Natural Abilities.	*Acquired Abilities.*
1. Strong and pleasing personality.	1. Knowledge of the subject.
2. Enthusiasm, under control.	2. Clearance of thought and expression.
3. Love for the calling.	3. Practical experience.
4. Common sense.	4. Putting essentials foremost.
5. Frank and direct in dealings with students.	5. Ability to inspire the right use of the imagination.
6. Sympathy.	6. Ability to inspire self-reliance.
7. Tact.	7. Co-operation.
	8. Mental self-poise.
	9. Accuracy.

Very truly yours,

PENNSYLVANIA STATE COLLEGE. A. J. WOOD.

TO THE EDITOR,

Dear Sir: If the discussion on "A Quiz on Quizzes" still continues, I have a suggestion to offer. As I give my examinations, I write out the answers to the questions on regular examination paper and then before the close of the examination, I post these just outside of the door so that the students can see them as they go out. I also place upon each sheet the number of minutes that it has taken me to write out the answer or work the problem. As I always keep my examination questions on 3 x 5 cards properly filed for future use, I am also making a collection of these answer sheets, which will be available in the future. If you think this idea worth mentioning, I should be glad to have you use it.

Very truly yours,

F. C. CALDWELL.

SOCIETY NOTES.

TREASURER'S MID-YEAR STATEMENT.

DEC. 31, 1915.

Received to date, current dues	$2,953.23
Back dues	263.00
Other sources	511.49
Cash on hand, June, 1915	1,038.32
Total	$4,766.04

Paid out, to date	3,977.82
Balance on hand	$ 788.22
Current dues outstanding	$3,039.27
Back dues outstanding	1,717.76
Other sources	679.51
Total	$5,436.54

THE K. S. A. C. SECTION OF THE S. P. E. E.

The meeting was called to order by Dean A. A. Potter and Professor G. B. McNair was appointed acting secretary in the absence of Professor L. E. Conrad.

Short papers giving notes of the Ames meeting were presented by Professors C. E. Reid, W. W. Carlson, I. I. Taylor and G. B. McNair.

Professor C. E. Reid: "In the opportunity to study at close range the methods and equipment of the Ames laboratories, I feel that I brought home some new ideas which we can modify and adapt successfully to our courses and equipment; in other cases, confidence in our own practices was strengthened by finding them satisfactorily regarded in other circles, while in still other matters a decision *not* to adopt plans which had been more or less seriously contemplated, was aided by observing the results of their being practiced in a like situation. Finally, a measure of content with our own laboratory was given by finding that while we might be excelled in some details, that in others we were better prepared to carry on our work.

The interest which I saw shown by all visitors in special devices in the laboratories, impressed upon me the fact that more of us should have written the Committee on Improvements in Laboratory Instruction, as they requested about a year ago, and sent them descriptions of any laboratory apparatus which we had developed or which we had found particularly useful."

Professor I. I. Taylor: "As a comparatively new member of the teaching profession, it was a source of pleasure and profit to meet and hear men old in the service. Many of these I had come to know and look up to in my undergraduate days through constant perusal of their texts on engineering subjects. It gave me considerable satisfaction to find such a body of men grappling with some of the very problems which I had not solved to my own satisfaction.

"It is to be regretted that the time for discussion on practically all the papers was cut short. This is the only criticism which I would offer to the formal meetings of the Society. This objection will no doubt be removed at future meetings by the giving of concise abstracts of the papers instead of reading the entire manuscript."

Professor W. W. Carlson: "The greatest good from any meeting of this kind comes, not from the papers presented, or from seeing the laboratories but from the discussions and from coming in personal contact with noted individuals whose names have been familiar to us for years but whose faces we have never seen."

Professor G. B. McNair stated that informal talks which he was able to have with the different men from different schools were considered by him as the most valuable part of the meeting. He also added: "Through these informal talks, I was able to learn of others' equipment, the text-books they used and their methods of applying certain courses. In every laboratory, one can find certain good points which are applicable to his own, but of which he may never have thought. Numerous suggestions were made to me along this line by men connected with other institutions.

"I earnestly hope that in the future the Committee on Arrangements will provide a little more time for gatherings where the members can discuss the matters of greatest interest to them, and thereby get the information which may be of greatest value to them."

COUNCIL ACTIONS.

The Council of the Society has elected by letter ballot twenty-six individual and three institutional members. The names of these new members will be found below.

NEW MEMBERS.

ANDERSON, R. J., Instructor in Metallurgy, University of Missouri, Rolla, Mo.

BAILEY, A. R., Assistant Professor of Civil Engineering, University of Michigan, Ann Arbor, Mich.

BEGGS, G. E., Assistant Professor of Civil Engineering, Princeton University, Princeton, N. J.

BLISS, C. P., Professor of Mechanical Engineering, University of New York, New York, N. Y.

CANNON, J. H., Associate Professor of Electrical Engineering, A. & M. College of Texas, College Station, Tex.

CARPENTER, D. E., Manager of Education, International Textbook Co., Scranton, Pa.

CHEDSEY, W. R., Assistant Professor of Mining, Colorado School of Mines, Golden, Colo.

COX, J. J., Assistant Professor of Civil Engineering, University of Michigan, Ann Arbor, Mich.

DIEDERICHS, HERMAN, Professor of Experimental Engineering, Cornell University, Ithaca, N. Y.

FULLAN, M. T., Professor of Machine Design & Drawing, Alabama Polytechnic Institute, Auburn, Ala.

HANNA, U. S., Associate Professor of Mathematics, Indiana University, Bloomington, Ind.

HITCHCOCK, W. A., Assistant in Engineering Mathematics, University of Colorado, Boulder, Colo.

KIMBALL, D. S., Professor of Machine Design and Industrial Engineering, Cornell University, Ithaca, N. Y.

KOERBER, G. A., Professor of Electrical Engineering, Delaware College, Newark, Del.

LANGILLE, H. B., Assistant Professor of Machine Design and Mechanical Drawing, University of California, Berkeley, Cal.

LANIER, A. C., Professor of Electrical Engineering, University of Missouri, Columbia, Mo.

MOORE, F. C., Associate Professor of Mathematics, N. H. College of A. & M. Arts, Durham, N. H.

MOYLE, M. W., Assistant in Mechanical Engineering, University of Colorado, Boulder, Colo.

PEHRSON, E. W., Assistant Professor of Mathematics, University of Utah, Salt Lake City, Utah.

SEARSON, J. W., Professor of the English Language, Kansas State Agricultural College, Manhattan, Kans.

PENN, J. C., Assistant Professor of Civil Engineering, Armour Institute of Technology, Chicago, Ill.

MALLORY, W. F., Instructor in Mechanical Engineering, University of Colorado, Boulder, Colo.

SHATTUCK, L. H., Instructor in Civil Engineering, University of Colorado, Boulder, Colo.

BROWNE, E. T., Instructor in Mathematics, University of Virginia, University, Va.

RIDOUT, JOHN, Student Assistant in Mathematics, University of Virginia, University, Va.

MUNRO, G. W., Assistant Professor of Mechanical Engineering, Purdue University, LaFayette, Ind.

LAFAYETTE COLLEGE, Easton, Pa., J. H. McCracken, President.

TOLEDO UNIVERSITY, Toledo, O., A. M. Stone, President.

UNIVERSITY OF COLORADO, Boulder, Colo., Livingston Farrand, President.

APPLICANTS FOR MEMBERSHIP.

BLACK, H. F., Professor of Mathematics and Assistant Professor of Engineering, Valparaiso University, Valparaiso, Ind. L. C. McCandliss, R. L. Glass.

MACKENZIE, C. J., Professor of Civil Engineering, University of Saskatchewan, Saskatoon, Sask., Canada. L. C. McCandliss, R. L. Glass.

MCCANDLISS, E. S., Assistant Professor of Civil Engineering, Missouri School of Mines, Rolla, Mo. L. C. McCandliss, L. H. Harris.

MERRILL, J. L., Instructor in Mechanical Drawing, University of Colorado, Boulder, Colo. W. C. Huntington, F. G. Allen.

OGLESBY, N. E., Instructor in Political Science, University of Virginia, University, Va. W. S. Rodman, E. J. Oglesby.

PARK, C. W., Assistant Professor of English, University of Cincinnati, Cincinnati, O. J. J. Long, G. R. Moore.

UNIVERSITY OF VERMONT, Burlington, Vt., Guy Benton Potter, President.

BOOKS RECEIVED.

Relativity and the Electron Theory. By E. CUNNINGHAM. Published by Longmans, Green and Co. 1915. Price $1.10 net.

The Use of the Slide Rule. By A. R. CULLIMORE. Published by Keuffel and Esser Co. Price 50 cents.

First Aid in the Laboratory and Workshop. By A. A. ELDRIDGE and H. V. A. BRISCOE. Published by Longmans, Green and Co. Price 35 cents net.

Mechanical Drawing. By JAMES D. PHILLIPS and HERBERT D. ORTH. Published by Scott, Foresman and Company. 1915.

BOOK REVIEWS.

Mathematical Tables. By MANSFIELD MERRIMAN. Published by John Wiley & Sons, Inc., New York, 1915. 67 pages. Price $.50 net.

This book is one of a series of mathematical texts for engineering students. It consists of tables of square roots, reciprocals and other functions of numbers which are used constantly by students of engineering. Other tables such as trigonometric functions, logarithms and weight and measures are also given. The tables have been taken from the American Civil Engineers Pocket Book although the page is slightly larger. The explanations are new and very profuse and should be very useful to the beginner. The tables on a whole give as high a degree of precision as is needed for most engineering work. Problems are added at the end of each chapter to assist the teacher.

R. L. G.

COLLEGE NOTES.

The Ohio State University.—The University has just commenced the erection of a building for shop instruction. The building will be a two-story structure of modern factory type, rendered fire-proof by the use of reinforced concrete and brick construction. The windows will occupy about 75 per cent. of the wall area, and will be fitted with metal sash. The building will provide space for forge, machine, pattern, cabinet, carpentry and vise work, both brass and iron foundry

and cabinet finishing, as well as class rooms adjacent to the shops for demonstration work principally, a reading room, large locker and wash rooms and the necessary stock and supply rooms. The building will probably be completed in August and ready for occupation in September.

The Engineering Experiment Station recently created by the State Legislature has been organized with the following Advisory Council: Professor E. F. Coddington, Acting Director, Professors C. E. Sherman, J. R. Withrow, W. T. Magruder, D. J. Demorest, A. D. Cole and F. C. Caldwell.

Provision has been made for the establishment of a liquid air plant and a refrigerating plant, but nothing definite has been done as yet regarding their installation.

A kiln is to be erected in the department of ceramic engineering. It will be round, approaching in size the type used in commercial operations, so designed as to be quickly convertible from the up-draft to down-draft type or operated as a combination of the two. Flue systems and fire boxes will be so constructed that they can be altered to permit of the study of variation in this type of kiln construction. It will be equipped to operate with solid, liquid or gaseous fuel. It is expected that this kiln will enable the department to carry on investigations under standard conditions, which should settle definitely a large number of problems which are hampering the progress of manufacturers of various clay articles.

The Pennsylvania State College.—Dean R. L. Sackett, of the School of Engineering, attended the Pennsylvania Industrial and Public Welfare and Engineering Conferences in Harrisburg, November 17–19. He spoke on "The Relation of Education to Industrial Efficiency," emphasizing particularly the industrial education work now being done in extension classes.

Professor C. L. Kinsloe spoke at the meeting of the Association of Iron and Steel Electrical Engineers held in Pittsburgh, November 13.

Mr. E. J. Ducey addressed the meeting of the Lebanon County Road Supervisors on November 23 at Lebanon, Pa.

Professor Hugo Diemer spoke before the Engineering Society of York, Pa., on November 19. His subject was "Training Efficiency."

The establishment of a new class in extension work in Chester, Pa., with an enrollment of about 100 brings the total enrollment for this year well above the 3,000 mark.

Eight members of the junior class in the department of architectural engineering have submitted drawings in the competition of the Beaux Arts Society of New York City. This competition is open to students in colleges having departments in architecture. The problem this year is the design of a free-standing tablet planned as a memorial to the soldiers who lost their lives at Vera Cruz.

University of Pennsylvania.—Dr. Robert H. Fernald, Professor of Dynamical Engineering, made an address at the sixth annual meeting of the York Chamber of Commerce, on Tuesday evening, November 16, at the Colonial Hotel, York, Pa. The Department of State has announced the appointment of Professor L. S. Rowe to represent the United States at the Second Pan-American Scientific Congress to be held in Washington, D. C., December 27, 1915, to January 8, 1916, inclusive. The following members of the faculty of mechanical engineering were present at the annual meeting of the American Society of Mechanical Engineers, held at New York City, December 7 to December 10: Professor R. H. Fernald, Professor H. E. Ehlers, Mr. G. S. Wheatley, Mr. P. J. Kiefer, Mr. G. B. Wharen, Mr. J. F. Allison.

Throop College of Technology.—Funds for the new $60,000 Chemistry Building for Throop College of Technology have all been secured; Mr. Elmer Grey, of Los Angeles, has been selected as architect; the site for the building has been located on the campus, and preliminary plans have been accepted. Work on the detail plans is now under way.

Dr. Arthur A. Noyes, who, beginning with 1916–17, will be

in residence at Throop College as Professor and Research Associate in Chemistry for half of each year, and who is to have an extensive and newly equipped research laboratory in the new Chemistry Building, is spending December at the College engaged chiefly in work on the plans of the new building, in conjunction with the other members of the Chemistry Department, Dr. S. J. Bates and Professor H. J. Lucas.

Throop College has just announced the appointment of Dr. William N. Lacey as instructor in inorganic and industrial chemistry, to take effect in September, 1916. Dr. Lacey received his doctor's degree at the University of California, and has since been connected with the Giant Powder Company of Giant, California. He will spend the remainder of the current academic year at the Massachusetts Institute of Technology, making a special study of methods of instruction there.

Lafayette College.—In the prospect of inaugurating at Lafayette College a coöperative course in mechanical engineering similar to that which has made the University of Cincinnati famous, Dean Fred E. Ayer, of the University of Akron, spent about a week at the college making the plans and disseminating information about such courses. At a luncheon given by President MacCracken to a number of the most prominent business men of the town together with trustees and faculty of the college, Dean Ayer outlined in detail the methods used at Cincinnati and Akron and pointed out the peculiar advantages which Easton presents to Lafayette for the establishment of such a method of engineering education. While no definite action has been taken with regard to the establishment of this method still it is strongly hoped, by Professor E. O. Fitch, Jr., head of the Department of Mechanical Engineering, that the coöperative work may start at the end of the present college year.

According to this scheme, the students in the Department of Mechanical Engineering will spend two weeks at work in the manufacturing plants of the vicinity and then two weeks

in the classrooms at the college. Alternating thus, they will continue through a course lasting five years of eleven months each.

A curriculum for a new Department in Chemical Engineering has been presented to the faculty for their ratification. This course will be inaugurated with the beginning of the college year in 1916.

University of Kansas.—An innovation in the way of meetings of the students' engineering societies has been introduced at the University of Kansas in the way of annual conventions and the days set aside for these meetings have been termed "Mechanical Engineers' Day," "Electrical Engineers' Day," etc. The idea of an annual meeting was introduced by the University of Kansas Branch of the American Society of Mechanical Engineers and it was very quickly adopted by the electrical and chemical societies. The general plan may be outlined by giving some details of the electrical meeting.

On one day of each year the electrical engineering students are excused from attendance on regular classes in order that they may be present at the annual meeting of the students' Branch of the American Institute of Electrical Engineers. The programme for this meeting occupies the entire day, closing with a banquet in the evening, and the technical papers are presented very largely by engineers not connected with the university.

These meetings concentrate attention upon the society, unify the students of the department, give opportunities for the students to meet practical engineers from the surrounding territory and hear them present live material, offer opportunities for the outside engineers to visit and become acquainted with the institution and, all in all, they have proved to be one of the most valuable parts of the work of the societies.

University of Illinois.—The College of Engineering of the University of Illinois is to receive from the Commonwealth Edison Company of Chicago, Illinois, through the courtesy of its president, Samuel Insull, as a museum exhibit a vertical

triple-expansion engine with its direct-connected generators and their equipment of transformers, regulators, switches, instruments, etc.

Mr. Insull's letter of presentation sets forth the fact that this engine, which was one of ten similar units, has a normal rating of 600 h.p. and was built in the year 1893 by the Southwark Foundry & Machine Company of Philadelphia, Pa. It was erected during the winter of 1893–94 in the power house of the then Chicago Edison Company.

Direct-connected to the engine, one on each side, were two 200-kilowatt, 150-volt direct-current generators, built by the General Electric Company. The Chicago Edison Company later replaced these generators with the present double-current machines which were among the first of this type of generators built. The unit was put into service on August 1, 1894.

By action of the board of trustees on March 9, 1915, four additional Research Fellowships were created in the Engineering Experiment Station, making fourteen in all.

OBITUARY.

AUGUSTUS JAY DUBOIS.

Augustus Jay DuBois was born April 25, 1849. He graduated from the Sheffield Scientific School in 1869, was awarded the degree of civil engineer in 1870 and the degree of doctor of philosophy in 1873. Later he studied mechanics for two years at the Mining Academy in Freiburg, Saxony, and from 1875 to 1877 was professor of civil engineering and mechanical engineering at Lehigh University. In 1877 Professor DuBois was appointed professor of mechanical engineering in the Sheffield Scientific School and in 1884 was transferred to the professorship of civil engineering which position he occupied until his death.

Professor DuBois was the author of some of the best-known

treatises on mechanics and stresses in the English language. His book on "Graphic Statics," published in 1876, was largely instrumental in introducing to American engineers the graphic method of determining stresses in framed structures now so widely used. This was followed by his translations of Röntgen's "Thermo-dynamics," Weyrauch's "The Calculation of the Strength and Dimensions of Iron and Steel Construction," and "Hydraulics and Hydraulic Motors" and "Heat, Steam and the Steam Engine" from Röntgen's "Mechanics." In 1883, his elaborate and original book on "Strains in Framed Structures" took its place as one of the most important contributions to engineering literature, being perhaps the first comprehensive treatment of the subject. A series of books on mechanics culminated in his "Mechanics of Engineering" published in 1901.

Professor DuBois was a member of the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Mining Engineers, the Connecticut Society of Civil Engineers, the Society for the Promotion of Engineering Education, etc. He died October 19, 1915.

OTHER SOCIETIES.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES.

At a recent meeting of the Advisory Committee for the 1916 National Exposition of Chemical Industries, plans for enlarging and increasing the scope of this coming Exposition were laid, which will assure a very large exposition both from the attendance standpoint as well as exhibits. The plans include using several floors of the Grand Central Palace, with speakers in the evening and motion pictures during the day from 11 A.M. to 7 P.M. This meeting will be held at the Grand Central Palace, New York City, the week of Sep-

tember 25, 1916. Dr. Chas. H. Herty has been elected chairman of this committee for the coming year.

AMERICAN ROAD BUILDERS' ASSOCIATION.

The date for holding the thirteenth annual convention of the American Road Builders' Association has been changed from the week of February 22, to the week of February 28, 1916, the closing day being March 3. This will be the only meeting of the American Road Builders' Association in 1916 and will include the Sixth American Good Roads Congress and the Seventh National Good Roads Show of machinery and materials. This exhibition will be held in Mechanical Hall, Pittsburgh, Pa., while the sessions of the Congress will be held in the adjoining auditorium. It is believed that the forthcoming convention and exhibition will be the best that has ever been held in this country.

---

916. Position of professorial grade in charge of a department, or leading to that end, in Mechanical or Testing Engineering wanted by one who is now an associate mechanical engineer in the U. S. Government Service. Has had over ten years' experience teaching engineering subjects and in charge of engineering laboratories. Experienced in commercial and testing engineering. Salary depending upon the opportunities offered, and the character and broad policies of the institution, but should not be less than about $3,000.

917. Professor of Civil Engineering desires change of position. Associate Member, Society of Civil Engineers and member of S. P. E. E. Ten years teaching experience, five years as head of department. Practical experience in railroad, highway, hydro-electric, and water supply engineering. First-class references.

THE UNIVERSITY OF VIRGINIA.

BY WALTER SHELDON RODMAN,

Associate Professor of Electrical Engineering.

"Ye shall know the Truth, and the Truth shall make you free."

The University of Virginia is located in the Piedmont region of Virginia, in Albemarle County, and just outside the present city limits of Charlottesville. To the north and west rise the foothills of the Blue Ridge, while in the distance may be seen the outlines of the Blue Ridge itself. To the south lie the Ragged Mountains, and to the east, beyond the city of Charlottesville, one finds Monticello, the home of Jefferson, beyond which stretches out to the horizon the level section forming finally the coastal plain. Charlottesville, a city of some 12,000 inhabitants, is situated practically in the center of the state, and is the junction and crossing point of two main railway lines, the Chesapeake and Ohio, east and west line, and the Southern, north and south line. Through trains from New York, Philadelphia, Baltimore and Washington pass through to Atlanta and New Orleans, while similar trains from Old Point Comfort, Newport News and Richmond go on to Cincinnati, Saint Louis and Chicago.

The University of Virginia is unique, particularly among the older institutions, in having had a most admirable and complete plan of arrangement thoroughly set down at the beginning, and, with but two minor exceptions, carefully adhered to in its later development. The result of this planning has been to present an almost perfect architectural ensemble, harmony being the key-note to which the ever-growing group of structures has been attuned. Mr. Jefferson, whose brain largely conceived the manner of setting to be chosen, also paid remarkable attention to the detail work which adds so

essentially to the charm of the structures. His decision to adopt the simple classic type of architecture, relieved from

Entrance Building and Memorial Gateway. The roadway, curving on the left, passes in front of the Hospital. The Long Walk, starting at the right-hand arch of the gateway, leads up beneath the trees and is visible at the right.

monotony by well-chosen departures from rigid sameness, has produced not alone a most harmonious and pleasing system but in addition one that serves to furnish examples of much of the best in the architecture of the ancients. The material used for the university buildings is brick, and the combination of the red of the brick with the white columns and their capitals gives a charming simplicity, elegance and grace, without the flaunting opulence of stupendous granite or marble halls.

Approaching the university from the city, the new entrance building, which houses the post-office, book-store, tea-room

and other stores, first meets the glance. Although not used for academic purposes it is part of the general group and conforms pleasingly in architecture with the rest of the university. Passing through the newly erected memorial gateway, the Long Walk stretches ahead furnishing a vista of the beauties soon to be unfolded. Just to the left is the University Hospital, consisting of a main section and two completed wings with a third and finishing wing for the north end already nearing completion. Adequate room for expansion of the hospital to the south is available and in time a medical group will doubtless be found about the hospital as a nucleus.

North End of the Lawn. Looking toward the south front of the Rotunda from the lower quadrangle.

Further to the south is the probable site for a new Chemical Building, plans for which are already under way. The Long Walk leads, under stately trees, up an incline which tests well the heart of the tardy student hastening to class and also the

equilibristic training of all when Winter occasionally spreads a glassy film over the pavement.

Still proceeding upward the arcades of East Range extend to the left. This is a part of the original Jeffersonian construction, and is composed of three hotels or two-story structures connected by one-story, one-room dormitory spaces, in front of all extending a covered walk with severe Roman arches affording a glimpse of the hospital group to the east.

South End of the Lawn. Cabell Hall is in the center, Rouss Physical Laboratory on the right. At the extreme right may be seen the pillars of the last pavilion on West Lawn.

The first building of this Range is the home of the Washington Literary Society, while the remainder is used for dormitory purposes. At the extreme south end of the Range is a large, modern dormitory, called the Randall Building. To the right of the Walk stands the Brooks Museum, which contains the geological museum and class rooms as well as the

office of the Director of the Virginia Geological Survey and the Virginia State Forester. This building is the most flagrant departure from the architectural harmony and was oc-

Vista Showing Serpentine Walls. This view is taken from back of West Lawn looking through toward West Range.

casioned by some mistaken idea which without doubt will never again be allowed to despoil the general scheme.

Stretching for a hundred yards back of the Range up to the back of a second group of domiciles called East Lawn is a series of well-kept garden spaces. The unique and attractive serpentine walls, one brick thick, serve as divisions between the gardens and to border the walks through them. Already the Rotunda is close at hand, this being the bright particular star in the firmament around which the other buildings seem to gather and group like satellites around their sun.

But a step now and the main quadrangle or The Lawn is

in full view. The Rotunda with its arch-supported terraces and noble portico closes the north end of The Lawn and houses the main library of the University. The Lawn descends by a series of four terraces to the south end of the quadrangle and is 200 feet broad by 1,000 feet long. Flanking The Lawn on either side for a distance of about 750 feet are the East and West Lawn colonnades. Standing on the

North Front of Rotunda. Ezekiel's Statue of Jefferson in the midground.

south portico of the Rotunda, on the left extend the colonnades of East Lawn with five pavilions separated by additional one-story dormitories; similarly on the right there sweeps the long line of low white columns, broken by the higher porticos of five more pavilions, each pavilion facing its companion across The Lawn. In front of these two colonnades extend double files of graceful maples, breaking the severity of the encolumned expanse. Here on The Lawn, all

by the way a part of the original design and construction in Jefferson's lifetime, is given a vivid picture of the best architecture of the ancients.

The Rotunda, Jefferson's Pantheon, more light and airy than its prototype, with massive Corinthian columns supporting a masonry dome of the Guastavino type, holds the gaze as by a magic spell. The pavilions then attract and continue to arouse the keenest pleasure as detail by detail their first-glance similitude dissolves and renders clear the classic features so admired since days long past. Proceeding down The Lawn and taking in order the pavilions facing each other on East and West Lawn, the panorama unfolds anew and before one appear the Ionic of the Temple of Fortuna Virilis, complete to wreaths and cupids of the frieze; the Doric of Diocletian's Baths; the Doric of Albano; the Corinthian of

Madison Hall. A view from north front of rotunda across main thoroughfare to the Y. M. C. A. Building. The meetings of the convention will probably be held here.

Palladio; the Ionic of the Theatre of Marcellus; Palladio's Ionic order with modillions; the Corinthian of the Baths of Diocletian; the Doric of Palladio; the Doric of the Theatre of Marcellus; and a variation of the Ionic of the Temple of Fortuna Virilis. Seven of these pavilions are used as residences by senior professors, one has become the Administration Building, another the Colonnade Club and the remaining one is reserved for the use of the Board of Visitors.

Thus ends the original Lawn of Jefferson, which was left open on the south. Now there appear two statues relieving the line of columns, on the east a replica of Houdon's Washington, and facing it on the west, probably the last work of Karl Bitter, his seated Jefferson. Completing the closure of The Lawn on the south is a modern group of three buildings on the Ionic order. The largest, the central one of the group, faces the Rotunda, and is the academic or Cabell Hall. Here are found the main auditorium, seating 1,200, and several lecture and laboratory rooms. Flanking it on the east is the Rouss Physical Laboratory, while opposite this latter building is the Mechanical Laboratory, the home of the Engineering Department. In the square formed by this group is placed Ezekiel's statue of Homer.

Just before reaching the Physics Building on the east side of The Lawn a broad walk leads down and out toward the Randall Building and East Range. Passing out of The Lawn by the Mechanical Laboratory on the west side another quadrangle is presented. On the right is the "Commons" or dining hall, a modern structure, while just ahead appears Minor Hall, the home of the Law Department, one of the newest and best appointed of the University group. Across a natural depression in front of "Commons," which may be destined to bloom as a sunken garden in the future, is a series of detached houses known as Dawson's Row, arranged on a circular arc and used as dormitories.

Back of Minor Hall is a stately residence now occupied by the Dean of the Engineering Department, standing on the

site of the former home of President Monroe. A thoroughfare leads southwest from here on which professorial residences are gradually appearing and but a short distance out are the golf links of the University and beyond them the "Barbecue" grounds. Here the old Virginia barbecue is held at various times and to attend one is indeed an education and an occasion for happy remembrance. Still further along, in a beautiful shaded spot lies the University cemetery and beside it the burial ground of scores of soldiers who wore the Gray. About one mile from the main campus, on an

The President's House. A modern structure in perfect keeping with its classic surroundings.

elevation named Mount Jefferson, stands the McCormick Astronomical Observatory, with its 26-inch refractor, said to carry one of the most perfect lenses ever ground by the famous Clarks.

Retracing the way back to "Commons" and turning north, West Range, which corresponds to East Range, is presented. Here are found the same severe Roman arches, hotels and dormitories. In one of the hotels the Jefferson Literary Society has for years made its headquarters. Facing the West Range is the new Peabody Hall or educational building, another Doric type, which will form one of the main features

Fayerweather Gymnasium. This structure is just east of the President's House, lower down on Carr's Hill.

of a future quadrangle. Some lesser, more or less temporary structures devoted to chemistry and medical work complete this side of the campus.

Directly to the north of West Range is the Chapel, an excellent example of Norman Gothic architecture, but furnishing on that account the second exception to the rule of harmony. Fortunately this structure is so placed that its non-

conformity does not seriously affect the appearance of the other units and it is consequently accepted with little censure. The main campus having now been circled, the Rotunda shows itself on the right and east. This view of the Rotunda is in some respects one of the most attractive since the whole scheme of balustraded esplanades and columned portico appear in full relief. The north portico of the Rotunda is less massive than the south or Lawn front and a long, broad flight of steps leads down to a broad esplanade upon which rises Ezekiel's statue of Jefferson.

Looking north, beyond the campus proper and across the main thoroughfare by the University, one sees Madison Hall, the Y. M. C. A. building, a finely appointed structure in perfect harmony with its classic surroundings. Broad lawns surround the building and at the back are found a score of well-kept tennis courts. Just to the west rises Carr's Hill, a graceful mound, topping which is the house of the President, still another modern structure built so as to preserve the general architectural features but in a somewhat lighter style than in the purely academic buildings. But a step further on and one reaches the Fayerweather Gymnasium, built in Corinthian style.

The campus has been left behind but the buildings in this immediate neighborhood are closely linked both by use and architectural features with the rest. Extending north on several parallel streets are well-built, handsome fraternity houses, many of them preserving the columned effect and seeming indeed a part of the harmonious setting.

A few hundred yards further on the Chesapeake and Ohio line is crossed and just beyond is the site for the new athletic club-house, already in course of construction.

To the west a magnificent view is presented. The athletic field with its concrete stadium, having a seating capacity of nearly 6,000, and forming a quadrant of a circle about an almost perfect gridiron and running track, offers the best field in the South. Standing on the stadium and looking

north, one sees University Place and Circle, an ever-growing group of residences largely occupied by the faculty members, with a few fraternity houses not far away.

To the west is an unobstructed view across the rolling field and out, ever-upward over foothills and ridges to the uneven skyline formed by the Blue Ridge in the distance. The sun is setting, all the west is aglow, nature's superb color scheme is being spread before one with all its delicate shades. Few scenes are more superb and one lingers to catch the last fleeting ray of pink against the blue-gray peaks. It is gone; evening shadows fall and with reluctant feet one slowly returns determined to see another and yet another glorious setting of the sun in old Virginia.

ECONOMY IN THE USE OF CLASS ROOMS AT LAFAYETTE COLLEGE.

BY WM. T. LYLE,

Professor of Municipal Engineering, Lafayette College.

The author of this paper is of the belief that the best results in the management of colleges and universities cannot be obtained by blindly applying the methods of the manufactory. In recent years, in the striving for a much needed improvement in management and method, too little has been said of the quality of the instruction given in our American institutions, and too little of the inspirational element. The writer is of the opinion, however, that there is an open field for marked economics. These economics should be effected whenever they do not interfere with the higher requirements of intellectual development. The following investigation was made with the idea that further economics might be practised at his own institution and the thought that a discussion of his findings might be generally useful.

In former years each professor and each instructor at Lafayette College had his own class room. Owing to the increase in the size of the faculty this is no longer possible. At the present time some rooms are used much more than others. Some rooms are used by one professor or instructor while other rooms are used by several; some by one department only and others by several departments. The following data have been collected for the second term of the year 1914–15 and illustrate in a general way the conditions obtaining for the first and third terms also.

Very little has been done among our educational institutions toward investigating room efficiency, though the Carnegie Foundation for the Advancement of Teaching is giving

attention to the matter and in Bulletin Number Five presents an article entitled, "The Economical Use of Buildings." It is to be hoped that in the near future the question will be given the attention which it justly deserves, and that great economies may be effected.

The following are the leading facts brought out in the present investigation: The number of students in attendance at the college during the year 1914–15 was 559. Of these 66 were classical, 294 scientific and 199 engineering; the number of class rooms is 31, with a total floor space of 25,282 square feet; the number of scientific laboratories is 11, with a total floor space of 11,568 square feet; the number of engineering laboratories is 11, with a total floor space of 8,059 square feet; the number of drawing rooms is 4, with a total floor space of 8,158 square feet; the number of shops for student work is 5, with a total floor space of 10,003 square feet.

The total floor space in the above rooms is 63,070 square feet, no account being taken of hallways and auditoriums, gymnasium, library and religious society rooms, museums, store rooms, offices, etc. The total number of class room chairs with tablet arms is 1576, which is 2.82 per student. The total black board area is 8119 square feet, or 14.5 square feet per student.

The following table shows the number of seats, floor area, black board area, actual hours per week of use and student hours per week; also the subjects taught. In addition it gives data as to use during examination week.

The accompanying diagram is self explanatory. Considerable irregularity will be observed in the use of laboratories, drawing rooms and shops, and it will also be seen that but few recitation rooms are used in the afternoon, especially from one o'clock to two.

As has already been said, the former policy of assigning a class room to each member of the corps of instruction has been by force of circumstances abandoned. There are at present but 17 recitation rooms used by one teacher only.

SECOND TERM CLASSES.

Building.	Room No.	No. of Seats.	Floor Area, Sq. Ft.	Sq. Ft. Black-boards.	Actual Hours per Week.	Student Hours per Week.	Use.
South College	1	35	480	268	13	245	Mathematics, Bible.
" "	4	40	1,080	312	15	297	Mathematics, Bible.
" "	8	42	630	248	20	213	Mining, mathematics, thermodynamics, Bible.
" "	9	36	626	224	23	444	English, Latin, Bible.
" "	13	85	1,080	348	11	140	Mathematics, Bible.
" "	17	51	896	152	14	485	Philosophy, Bible.
" "	18	44	1,024	188	19	286	German, French, Bible.
" "	19	45	960	356	21	175	Greek, Bible.
" "	20	36	600	320	21	360	Latin, Greek, Bible.
" "	21	58	900	80	7	134	Latin, Bible.
" "	25	30	444	200	17	334	Mathematics, English, Bible.
" "	26	45	730	300	19	372	Mathematics, astronomy, English, Bible.
" "	30	47	992	144	19	314	German, Hebrew, Bible.
" "	31	50	960	104	15	176	French, Italian, Spanish, Bible.
" "	Mining laboratory	....	780	0	....	....	Mining engineering.
" "	Metallurgy laboratory	....	736	0	10	320	Metallurgy.
" "	Gas laboratory	....	736	0	....	....	Mining engineering.
Astronomical Observatory	Class room	30	616	276	19	326	German, French, Bible.
" "	Instrument room	....	195	....	....	....	Astronomy.
" "	Instrument room	....	195	....	....	....	Astronomy.
Mechanical Engineering Building	Machine shop	....	3,510	....	22	114	Machine work.
Mechanical Engineering Building	Sheet metal shop	....	1,120	....	16	48	Sheet metal work.

SECOND TERM CLASSES.—*Continued.*

Building.	Room No.	No. of Seats.	Floor Area, Sq. Ft.	Sq. Ft. Blackboards.	Actual Hours per Week.	Student Hours per Week.	Use.
Mechanical Engineering Building	Forge	....	1,080	....	22	72	Forge work.
Mechanical Engineering Building	Foundry	....	1,188	....	22	80	Foundry work.
Mechanical Engineering Building	Pattern shop	....	3,105	....	22	148	Pattern work.
Pardee Hall	1	28	1,456	192	28	452	Framed structures, sewerage design, mechanics of materials.
" "	2	....	1,800	60	12	250	General testing.
" "	3	31	710	152	12	216	Public water, supplies, mechanics of materials, concrete, metallurgy, Bible.
" "	4	100	1,456	102	22	690	Economics, history, business law, Blackstone, English, Bible.
" "	5	....	1,800	176	10	260	Surveying.
" "	6	35	462	164	10	181	Thermodynamics, steam engine, Bible.
" "	8	70	1,080	328	19	353	English language, current events, politics.
" "	10	50	912	300	8	114	Mechanics of materials, descriptive geometry.
" "	11	....	1,800	120	16	494	Mechanical drawing.
" "	12	23	420	240	4	46	Descriptive geometry.
" "	16	43	576	260	24	383	Surveying.
" "	22	54	1,400	80	16	410	Geology.
" "	27	24	3,102	104	12	75	Machine and boiler design.

SECOND TERM CLASSES.—*Continued.*

Building.	Room No.	No. of Seats.	Floor Area Sq. Ft.	Sq. Ft. Black-boards.	Actual Hours per Week.	Student Hours per Week.	Use.
Pardee Hall	31	....	1,560	27	37	567	Electric testing.
" "	33	....	536	0	....	....	Physics store room.
" "	34	....	1,560	0	30	582	Physics testing.
" "	35	90	1,050	208	4	244	Physics.
" "	36	24	525	224	12	141	Electrical engineering.
" "	37	36	750	344	14	280	Physics.
" "	39	25	505	296	4	72	Boilers and valve gears.
" "	40	34	750	372	14	185	Mathematics.
" "	41	42	735	336	8	152	Mathematics.
" "	42	....	1,800	120	10	268	Mineralogical laboratory work.
" "	Concrete laboratory	....	430	....	10	60	Concrete testing.
" "	Road matl. laboratory	....	390	....	4	16	Road matl. testing.
" "	Cement laboratory	....	560	....	16	96	Cement testing.
Gayley Hall	1	....	1,188	....	18	588	Beginner's lab., chemistry.
" "	3	23	280	46	13	248	Chemistry.
" "	4	....	392	....	6	96	Assaying.
" "	5	....	612	....	Constant	....	Shop—chemistry.
" "	6	....	306	....	....	....	Stores—chemistry.
" "	7	....	150	....	Constant	....	Gas analysis.
" "	8	....	1,188	....	22	304	Organic lab.
" "	9	....	176	....	....	....	Organic stores.
" "	10	....	540	....	Constant	....	Oliver library.
" "	12	105	1,296	30	9	264	Chemistry and metallurgy.
" "	14	....	1,188	....	22	366	Qualitative lab.
" "	15	....	200	....	....	....	Stores—chemistry.
" "	16	20	240	138	16	214	Chemistry.
" "	17	....	1,296	....	10	188	Quantitative lab.

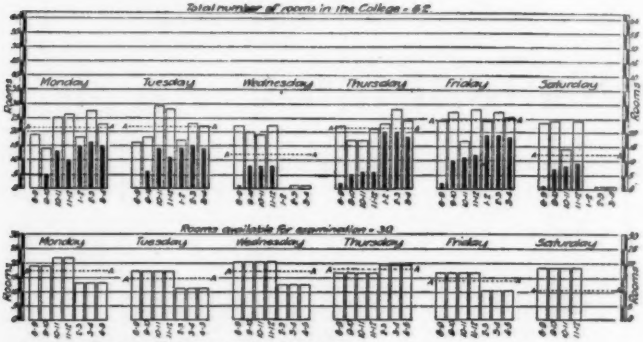
SECOND TERM CLASSES.—*Continued.*

Building.	Room No.	No. of Seats.	Floor Area, Sq. Ft.	Sq. Ft. Black-boards.	Actual Hours per Week.	Student Hours per Week.	Use.
Jenks Hall	....	....	630	....	15	300	Bacteriological laboratory.
" "	....	....	220	....	15	300	Preparative laboratory.
" "	....	....	520	....	....	....	Vivarium.
" "	....	45	882	180	9	150	Biology.
" "	....	....	1,728	....	Constant	....	Biological lab.
" "	....	....	600	....	....	....	Physiological lab.
" "	....	....	559	....	....	....	Biological museum.
" "	....	....	1,292	....	....	....	Biological museum.
" "	....	....	396	....	....	....	Biology.
EXAMINATION SCHEDULE.							
Observatory	.....	.....	.....	.....	14	308	
Pardee Hall	1	.....	.....	.....	4	60	
" "	3	.....	.....	.....	23	417	
" "	4	.....	.....	.....	36	2,433	
" "	6	.....	.....	.....	10	146	
" "	8	.....	.....	.....	18	404	
" "	10	.....	.....	.....	3	69	
" "	11	.....	.....	.....	6	327	
" "	12	.....	.....	.....	4	72	
" "	16	.....	.....	.....	4	88	
" "	21	.....	.....	.....	15	533	
" "	35	.....	.....	.....	19	820	
" "	36	.....	.....	.....	11	148	
" "	37	.....	.....	.....	4	68	
South College	1	.....	.....	.....	23	505	
" "	4	.....	.....	.....	26	695	

EXAMINATION SCHEDULE.—*Continued.*

Building.	Room No.	No. of Seats.	Floor Area, Sq. Ft.	Sq. Ft. Blackboards.	Actual Hours per Week.	Student Hours per Week.	Use.
South College	8	.....	.....	.....	18	306	
" "	9	.....	.....	.....	18	381	
" "	13	.....	.....	.....	21	538	
" "	17	.....	.....	.....	16	908	
" "	18	.....	.....	.....	15	233	
" "	19	.....	.....	.....	13	190	
" "	20	.....	.....	.....	22	468	
" "	21	.....	.....	.....	12	232	
" "	25	.....	.....	.....	16	300	
" "	26	.....	.....	.....	23	474	
" "	30	.....	.....	.....	10	128	
" "	31	.....	.....	.....	16	353	
Jenks Hall	....	.....	.....	.....	11	131	
Gayley Hall	12	.....	.....	.....	20	604	

While it is highly desirable that each room may be used for a large number of hours, questions of ventilation and convenience must also be considered. Many teachers are in the habit of placing drawings, tabulations, etc., on the black boards before the arrival of the class and often like to leave matter on the boards for several days. Sliding black boards



The light plottings, Upper Diagram, show the total number of recitation rooms, laboratories, drawing rooms and shops used each hour of each day throughout the week. The heavy plottings show the number of laboratories, drawing rooms and shops in use. The difference of the light and the heavy plottings thus indicates the number of recitation rooms. The total number of available rooms is 62. Normal lines A-A are drawn for each day showing the average number of rooms in use for each hour of that day.

The plottings, Lower Diagram, show the number of rooms used for examination each hour of each day during examination week

Diagrams Showing Number of Class Rooms used at Lafayette College Second Term 1914-15

are used at some institutions in rooms occupied by more than one teacher and are found very convenient for preserving the work from day to day. The work of the students however is done on fixed slates and a serious difficulty often arises when time to grade the black board work is required with another class entering the room immediately at the end of the hour.

The following data are extracted from the report of the Carnegie Foundation referred to above. From this report it would appear that at Williams College each room is used 2.83 hours per day. At Fayerweather Hall, Columbia University, seven rooms devoted mainly to Physics and Mathematics are used 3.45 hours per day per room. The author of the article, Mr. Morris L. Cooke, states, "the authorities at

Columbia had evidently given this matter thought and had subjected it to some control. I doubt if any better showing can be made by any other building anywhere." The average at Lafayette for recitation rooms is 2.34 hours per day per room. Low averages on Wednesday and Saturday (1.94 in each case) tend to depress the average. For Monday, Tuesday, Thursday and Friday for recitation rooms the average is found to be 2.55 hours per day per room. For all rooms in the college the average is 2.17 hours per day per room. This is for recitation rooms, laboratories, drawing rooms and shops, being increased to 2.56 hours per day per room for Monday, Tuesday, Thursday and Friday.

These averages as the college grows could probably be increased as follows:

1. Shortening laboratory periods from three hours to two hours. This will permit greater flexibility in the schedule since one laboratory period and two recitations can be thus scheduled in the morning, instead of one recitation and one laboratory period by the present arrangement. (Classes are scheduled from eight to twelve every morning and from one to four on Monday, Tuesday, Thursday and Friday afternoons.) Furthermore by the two hour plan, one laboratory and one recitation can be scheduled for the afternoon which is also a decided advantage as far as the schedule and room efficiency are concerned.

2. Using Wednesday afternoon for classes.

3. Assigning rooms by a central committee. Mr. Cooke says, "the management of all buildings should be in the hands of some central authority, and operated under as complete rules as can be established; the same rules, of course, applying to all buildings, no matter what the purpose for which they are used. These rules should be public. It is impossible for the various rooms to be used economically if they are administered by the departments nominally in control of the buildings in which they are located. A professor in one department has not the information about the conditions in

another department that would make it possible for him either to lend the rooms or borrow them to advantage. That is what they are supposed to do now, and there is little of it done."

4. Adding to the present quota a few more small rooms.

5. Using more effectively the lecture method of instruction. By this large classes can be handled and high efficiency attained in the use of the rooms.

6. Abandoning the old idea that recitation rooms are the property of one teacher or of one department. They should be assigned in such a way by the central committee as to make their usefulness a maximum. Mr. Cooke describes a physics lecture room at the University of Toronto with removable experimentation table. This room at an hour's notice could be put in order for meetings of the Cercle Française. In certain courses at the Massachusetts Institute of Technology the lecture tables for physics demonstrations are set up outside the lecture room and rolled in and out on tracks. Where the arrangement of apparatus is a matter of much time the gain here is very apparent.

In order to facilitate the conduct of examinations one or two more large class rooms are much to be desired.

The foregoing data and criticisms are freely offered in the hope that through discussion they may result in an improved condition both here and elsewhere. In conclusion the writer acknowledges the invaluable assistance of Professors Fitch and Roberts of this college who aided him in his investigation.

THE DEVELOPMENT OF ENGINEERING WORDS.

BY J. M. TELLEEN,

Department of English, Case School of Applied Science.

Were Benjamin Franklin to appear among us with the vocabulary he used as an experimenter, he would find himself decidedly handicapped in trying to follow the discussion of the present day engineer. Were he to read even the popular magazines, he would find an abundance of technical terms, most of which would confuse rather than enlighten him. For instance, in a recent issue of *The Saturday Evening Post* he would find in the advertisements numerous technical terms, among which are *aeroplanes, alternating- and direct-current motors, aluminum fittings, candlepower, carbon lamp, center control, dash adjustment, dry battery, elevated railways, floating-type rear axle, four-cylinder, high-tension magneto ignition, ignition point, indirect lighting, insulating material, loop filament, magnetic speedometer, platinized, semaphores, spark plug, steel garage, storage battery, telegraph poles,* and *vapor- or vacuum-heating plant.*

As some of these terms serve to explain commercial products of rather general usage, they have become to a certain extent popular. The constant transition of technical terms to popular usage is evidenced not only by their frequent appearance in advertisements, but by the necessary publication of such a pamphlet as that issued by the National Carbon Company, entitled "Analogies Between Current and Battery Flow." This ingenious explanation of electric phenomena and terms was necessitated by the very extensive use of batteries in residences, automobiles, launches, etc. A further illustration was offered a few years ago when our towns and cities were

holding airship exhibitions and tournaments, and our newspapers were educating their readers by printing vocabularies with detailed explanations of the more commonly used terms in aeronautics and then freely using these terms in the news columns.

This constant transition, however, is not as interesting as their manner of formation and their later fate. Only a few years ago a common subject of discussion was a new self-propelling pleasure vehicle, for the designation of which several names were proposed as *horseless carriage* and *automobile*. In the midst of this general discussion, the hybrid compound that was formed by joining the Greek *auto* to the Latin *mobile*, came to be universally adopted, though the highway engineer found it necessary to make a technical distinction by using the term *motor-driven vehicle*. *Automobile* immediately passed into the class of popular words and with its universal adoption it received its characteristic popular synonyms. We have the barbarism *auto*, the synecdoches *motor*, *machine*, and *car*, and the facetious references in *boat* and *jitney*. The word *auto* undoubtedly will prevail, as have such barbarisms of the past as *bus* and *cab*.

It must be admitted that on account of its extreme popularity the term *automobile* is exceptional in the matter of its origin and later development. No other technical word has become so universally popular in so short a time. Most engineering words have remained technical, as will be noted in considering them from the point of view of their origin. The four classes into which these words may be grouped are popular words that have been given a special technical meaning, Greek and Latin words in their original form, compound words, and proper names.

Old familiar words with a rather general and at times indefinite signification have been employed to designate some technical process or contrivance. The word *fuse* as used by the electrical engineer has apparently little in common with the word in its general meaning. The adjective *dirigible* is

to-day common as a noun in aeronautics. In a recent treatise Professor Pender begins by defining the word *generator*, for, as he points out, the word does not mean in electrical engineering what its etymology denotes. *Concentrate* and *shoot* are old words that have been adopted by the mining engineer to designate modern practice. The word *ore* has several meanings and to-day the expert must insist in giving it not only a scientific but also a technical meaning. Even an international society is concerned in its deliberations on determining the technical meaning of such old familiar words as *power, load,* and *force.* This list of words can be greatly extended with such simple words as *cradle, cushion, collar, hood, cap, shoe, arm, brace,* and *socket.*

Compound words of the second class are composed either of words already in general use in English or of Greek and Latin roots. Typical of the first class are such terms as *horsepower, Z-bar, tool-steel, chain-drive, cross-beam, blast furnace,* and *reinforced concrete;* and of the second group such terms as *telegraph, telephone, petroleum, microscope, micrometer, pyrometer,* and *millimeter.* Most of these words are quite recent in their origin, while a few are old and as such have undergone the experiences to which a word is normally subjected by constant usage. For instance, the etymology of the word *manufacture* reveals the original meaning of the word, the present meaning revealing an industrial revolution. Etymologically the word denotes hand-made. During the gradual but general transformation in the method of making most of our tools, utensils, and other articles of commerce, during the transition from the days of manual labor to those of machines, the word continued to be applied to hand-made as well as machine-made articles, but now the Latin *manufactured* is synonymous with *machine-made.* To convey the original meaning of *manufactured* the simple Anglo-Saxon compound *hand-made* is used.

In coining these compound words an inventor occasionally experiences difficulty in finding a suitable word for his new

contrivance. Take for instance the so-called talking machines. The dictionary informs us that a graphophone is "an improved phonograph, whose cylinder is of hard rubber in place of wax." The reader needs only to consider his own use of the words *phonograph* and *graphophone* to determine whether their commonly accepted connotation depends on whether the cylinders in question are made of wax or rubber. The Greek roots of these two words, *phono* meaning sound and *grapho* meaning recording, would have formed the logical name for Professor Miller's new invention for recording sound waves. As both of the possible compounds had been preempted, the word *phonodeik was coined.* It should also be stated that at present trade names are used to designate the various commercial talking machines.

That the formation of these compound words does not meet with favor on the part of those who are intent on preserving the purity of the language is apparent from the objections raised to certain technical words. The so-called hybrid compounds, in which one part is taken from one language and the other from a different one, have been especially a subject of attack. Examples of such words are *cablegram, automobile,* and *dictograph.* Objection has likewise been made to adding the Greek termination *ize* and *ist* to words of Anglo-Saxon origin and the Anglo-Saxon termination *er* to words of Greek origin. Disregarding the possible claims of euphony we would then have *experimentist, photographist,* and *telegraphist* instead of *experimenter, photographer,* and *telegrapher.* Mathematicians are accused by Richard Grant White in his "Words and Their Uses" of using such words as *tangential* and *exponential* in which the *i* of the suffix serves no phonetic value, as it certainly does in words like *official, consequential,* and *commercial.*

The third class of words according to their origin are the Greek and Latin words that have been taken into the English language unchanged in form and with their original declension. These words are scientific rather than strictly engineer-

ing. The Greek *phenomenon* with its plural is familiar. Among the Latin words are found representatives of the various declensions: *formula, antenna; radius, nucleus; datum, medium; index, apex, analysis, genus; apparatus.* Most of these retain their original plural form, though in the case of *formula* the English plural *formulas* is as common as the Latin *formulæ* without any distinction made as to meaning. The word *index,* on the other hand, has the English plural *indexes,* a popular word used in speaking, for instance, of card indexes, and *indices,* which has a technical meaning in mathematics. *Data,* the plural of *datum,* a few engineers especially in the field of electricity regard as a singular collective noun, but fortunately this practice is not general. *Datum* is generally used as an adjective, as in datum sheet.

The fourth class consists of the words that bear the name of the discoverer or inventor. The words *mackintosh, macadam, babbit, watt,* and *ohm* are more or less familiar words and are universally written with small letters. Compare these with such terms as *German silver* and *Portland cement,* in which conservatism insists on the use of capital letters in the writing of adjectives referring to a country and to a locality, although a few writers use small letters. Capitals are retained in such terms as *Bessemer process, Roentgen rays,* and others containing the name of the scientists who are still living or of those who are still closely associated with the discoveries or inventions. When the name of such individuals as Galvani, Harvey, and Bessemer are used in verbs as *galvanize, harveyize,* and *bessemerize,* in which the process is considered without much thought of the inventor, the inevitable tendency is to drop the capital. A rather interesting illustration of capitalizing a word on account of its associations is found in the word *centigrade,* which is frequently capitalized by virtue of its being associated with the names of two scientists, *Fahrenheit* and *Réamur.*

English is a living language and as such its words are subject to all the natural forces that make for uniformity as well

as diversity. What is true of the language as a whole is necessarily true of each division as engineering terminology. The journalist and the teacher especially would see all forms of expression made uniform so that the words and terms in general may prove accurate in their denotation and pass current throughout the engineering world. However, the street and the stage will continue to issue its slang, and the shop and the mine will insist on adopting its own cant. Even the nations seem to assert a personal pride in maintaining their own special coinage. The laborer speaks of *juice, gas, old men,* and *shorts,* and the engineer speaks of *electricity, gasoline, brace,* and *short circuit.* The British insist on using *petrol, lift, goods train,* and *glow lamp,* while the American with equal persistency adhere to *gasoline, elevator, freight train,* and *incandescent lamp.* The scientist insists on the form *aluminium,* but the business man, at least in America, maintains the form *aluminum.* The scientist has decreed that the word *benzine* is to be used to denote a petroleum distillate and *benzene* a coal-tar product, but the forms *gasolene* and *gasoline* are still used indiscriminately without any distinction as to meaning.

An instance of the refusal of diction to conform to uniformity is found in the adjectives with the suffixes *ic* and *ical.* A rule once given was: "Always prefer the simpler form ending in *ic.*" A better rule is given by Mr. T. A. Rickard: "Use adjectives with the suffix *ic* in referring to natural phenomena, relations, and products, and the suffix *ical* in referring to the works of man, as research, literature, and speculation." A term that conforms to this rule is "topographic map of the United States Geological Survey." The distinction, however, is not apparent in the names of two periodicals, *The Electric Journal* and *The Electrical World.* That the rule is not universally applicable is also apparent from the connotation of these several pairs of words, *mechanic* and *mechanical, electric* and *electrical, physic* and *physical, medic* and *medical, economic* and *economical,* and *historic* and *his-*

torical. *Mechanic* is a noun and refers to a skilled mechanician. *Mechanical* has two distinctly different meanings as in mechanical engineer and mechanical man. *Electric* as a noun is the name of a kind of automobile, as an adjective it is generally chosen to designate an electrical product of commerce, as electric iron. *Medic* is slang for a medical student and has been dropped as an adjective. *Economic* has reference to the science of political science, *economical* is a synonym of frugal. The physicist finds that both *physic* and *physical,* as generally used, are so remote from his science in their connotation that he is obliged to use the noun *physics* as an adjective.

With the general progress in all fields of engineering new words and new forms of words will be constantly introduced into the language and the tendency to standardize all details of expression will become more and more powerful. Individuals will condemn bad usage and will formulate precepts for its correction. Societies will issue their definitions and rules. Possibly when some bureau is authorized and is recognized as qualified to pass judgment on all matters of good use in engineering diction, the denotation of all troublesome terms will be determined and uniform usage will be established throughout the English speaking world. And even then all the forces that tend to bring about diversity will continue to assert themselves and prove conclusively that English is a living language.

THE FUNCTION OF A MUNICIPAL TECHNICAL SCHOOL.

BY A. R. CULLIMORE,

Dean, College of Industrial Science, The Toledo University.

An engineering or industrial education is chiefly concerned with the preparation for the business or the work of life.

Broadly considered this type of education fails in two ways.

First, a student is led in many instances to become a technically trained rather than a broadly educated man. It is held that the tendency of modern technical education is narrowing and that the man is a machine rather than a leader at the end of his education.

Second, many students are trained along branches of learning for which they are not particularly fitted, that is to say, after some time students decide that they have chosen a line of work for which their talents do not eminently fit them. A glance through the register of graduates of any technical school will bring to light that there are many misfits.

In regard to the first point, engineering schools are taking steps to remedy the defect by introducing into their curricula subjects of more or less (so called) cultural value.

The second point has not been given, in the past, the attention that it richly deserves.

Engineering educators will agree that a very large percentage of the students at entrance have not the peculiar talents and personality which preeminently qualify them for the profession of engineering. It seems very strange that up to the time of entrance into college no particular and distinct attention has been given to the question of really finding out what the boy wants, likes, or has an aptitude for doing and doing well.

These same educators will further agree that they graduate every year men, who while passing every required subject in a fairly satisfactory manner, still have not those peculiar talents before mentioned, in a degree sufficient to warrant their entrance into the engineering profession. On the other hand it is equally true that many boys who have these talents in a very large measure, have been forced by circumstances to forego an education by which they could most surely profit.

A system of technical, or in fact any other kind of education, which would put the right man in the right place would seem to be highly desirable. Under the present system the waste is enormous chiefly because *no correlated attempt is made to determine early in a student's education for what he is best fitted.*

Why do so many boys enter our engineering schools and why is the mortality in these schools so high? How many men entering our engineering schools do so because they have been told by a competent adviser that they have the talents for such a career? How many boys have chosen electrical engineering as a profession because there was a time when an electric battery had a fascination?

And now that the boy is in college how many instructors are capable, even if they are willing, to judge broadly of his fitness at the time when he is a freshman or a sophomore? It is true that in the last two years of a four-year course the student may be brought into contact with men who are able to judge of him rightly. Instructor *A* teaches him mathematics, instructor *B* descriptive geometry. Particularly in our larger institutions no professor with a broad engineering training and a practical knowledge of the things that make primarily for success or failure, has a chance in the first two years to judge the student as a man as well as a scholar.

It has been said that it is unfair to judge a future engineer by his marks in calculus, for instance; and this would in a large measure be true, if calculus were an end in itself. However it seems fair to assume that industry, honesty, ap-

plication, enthusiasm, and creative thinking should appear, *if looked for,* in a directed study of the calculus.

It would seem, however, an impossibility for a teacher of calculus instructing a section of 25 students, and called upon to turn out men conforming to a certain standard of mechanical dexterity with the symbols of calculus, to tell at the end of a semester what men had proper intellectual qualifications. The fact stands out that teachers of calculus, as well as other teachers, are interested in the *subject* in which they instruct, rather than the *students* which they are developing.

With these ideas in view and as a basis, the junior college of engineering and industrial science of Toledo University has been organized.

This college of the university gives only two years' work in engineering, but of a grade which is equal to that of the best engineering colleges of the country. The college also offers industrial night courses in mechanical and structural drafting, electrical and machine shop practice. It should be clearly borne in mind that while these two departments are distinct as regards the work which they offer, their coöperation and correlation are fundamentally necessary to the success of the plan as a whole, as will appear later.

Again let it be said that the twofold idea underlying the scheme is first to weed out ruthlessly the undesirables, and second, to offer to the desirables who have neglected their education, a chance to place themselves where their capabilities can be developed.

As to the methods of discovering the fit and the unfit; all possible data obtained from the parents and former teachers of the student are gathered and consulted. The boy is studied carefully in the light of all that our modern psychology teaches. In a word, the boy is studied thoroughly as a problem from every possible angle, and the instructing staff is thoroughly imbued with the idea that it is of the utmost importance that data be collected and at least a tentative solution reached as soon as possible.

The members of the instructing staff are chosen with the idea in mind that they are not only to teach the subject matter in their various fields; but that they are men with character and sympathy enough to bring out the best in a student; interest and enthusiasm enough to be continually on the alert to catch the responses of the student, and experience enough to draw correct conclusions.

Frequent private conferences are held between the student and the instructor and between the various instructors as well. The boys are talked over, thought over, and sometimes fought over, always with the idea of bringing strongly to the surface anything that lies below.

A short course of lectures in the first year is given dealing in a general way with the ideas and ideals of engineering as a profession, and the qualifications necessary for a successful engineer are discussed. This course is given by a man of engineering experience, and every means is taken to bring the student into personal contact with the instructors who are in active engineering work. And here it may be said that it is very important, we believe, to have men as instructors who have actually engaged in active practice.

Lectures, outside the regular work, throughout the two years are given by men who are practicing engineers or whose work is such as to require them to employ engineers.

The students in both years are required to read at least one paper before a public gathering on some phase of their work. Two men taking analytics during the past year presented papers on the following subjects: "A Proof of the Pythagorean Hypothesis by Analytics"; and, "A Discussion of Degenerate Conics."

The course in English is given with the idea of learning about the student as well as teaching him something.

The standards of the work are kept very high, problems must be in exactly on time. The idea is fostered that the man is called upon to work intensively in school as well as in business, and right habits of study are considered very important.

The classes are small, ten being the maximum number of students in one section, for, as can be seen, the man must be watched very closely.

Lastly, the man is advised, frankly and honestly, straight from the shoulder when occasion warrants. Sometimes it is not long before he is advised to leave school entirely; there is no long period of probation.

The results during the three years that the school has been in existence have been rather startling. Less than 20 per cent. of the students have satisfactorily completed the two years' work. Some have failed to take our advice and have gone to other schools; their records in other colleges have led us to believe that our judgment was well founded.

It will be said that very often the men who are the best students in the last two years of a college course have been among the poorest in the first two years. This is true. What is the reason? Two may be mentioned. The first is that a man may develop; the second, it may be that his teacher in algebra marked him solely on the basis of his facility with algebraic symbols which most certainly had nothing to do with the judgment which he might later show in the design of a power plant; and really neither of these have very much bearing on his future ability to impress a board of directors with the feasibility of a certain development.

Fairly and squarely, does the average engineering college spend much time in the first two years worrying about the success these young men are to make in the future? Remember, to hold a student over a year when you know down in your heart that there is no hope, means infinitely more to the student than to the teacher, and more to the parent than to the student. The determining factor should be the promise shown together with the work done.

Where do we send the students upon the completion of their courses? This leads to the consideration of another phase of the situation. We have within a radius of 100 miles, four technical schools whose equipment is of the highest order. We

see no reason why we should attempt to duplicate this equipment. These schools in common with the schools of the whole United States are individually eminent in certain branches of technical work. If the man is fit we send him to the best school we know for the particular kind of work for which we consider him best fitted. So far our graduates have been few and they have had no trouble in earning enough to insure their education in other schools. We believe that when the type of man we turn out is known and appreciated that any school will be glad to welcome our graduates.

As our institution is supported by the municipality, we are hoping in the near future to be able to offer to our students, who have proved their fitness, a scholarship to any university that we may choose. We believe, that in the name of efficiency, such an arrangement would be better than the duplication of expensive technical equipment.

Now in regard to the function of the industrial night school; our student body in this work is recruited mainly from the drafting rooms and shops of the industrial plants of the city, the average age of the students at entrance being slightly over 18 years.

The courses are arranged so as cover two or three years with a solid grounding of mathematics and drawing in all of the courses. The industrial students are closely watched in much the same way as are the engineering students. In case a man shows promise he is advised to take up the engineering work. His night-school training has given him the necessary work in mathematics, drawing and in most cases physics as well. He is deficient, therefore, in history, English, and foreign language. In almost every case we find that the boy has covered in high school a part of these requirements and by devoting his time in the summer and his spare evenings he is able to enter with a maximum of three conditions. These have in every case been removed before the completion of his two years' course.

We find in Toledo, as is true presumably of every city of the

same type, many boys who have failed to complete their high school course. After two or three years they realize their mistake. To these boys we offer a way out of a real difficulty. Their work in the night school serves as an apprenticeship and if they are worth it we send them higher.

In advising a student of this type who we feel has the capacity to profit by an engineering training, we point out that he must be prepared to make any sacrifice to the end in view. No false hopes are raised but the man is assured that unless our judgment is at fault, he has more than a reasonable chance to make good.

We have found many boys with real talents coupled with great ambition and a dogged persistence which has put them through in fine shape and our best students have come from this class of men.

Such men seem to appreciate better the spirit of work, and they have a better perspective and sense of proportion than the men fresh from the high school, this is due, of course, to their greater age and experience. In most of our engineering schools the problems of the teacher are confined largely to dealing with boys who have just come from the high school ostensibly fully prepared; perhaps these teachers cannot appreciate to the full the position of the boy who stopped too soon and wants to come back. Those of us who have seen such a boy win a long uphill fight for a higher education, feel that it is one of the finest things in education.

As can readily be seen this plan calls for small classes and teachers with personality and character plus unbounded enthusiasm and devotion to the highest ideals. Such work as we are doing calls for much individual attention to the student and the expenditure of much time outside the class room. It certainly cannot be applied with success in a large institution.

When listening at Ames to the presidential address of Dean Marston with its idea of the coöperation and unification of vocational education, I wondered if this idea of a municipal technical college would not *go a step towards completing* a

great system of vocational education. Let every city have a junior engineering college coöperating on the one hand with the local board of education and the industrial night school and on the other with the state university. Let this school choose from a wide field, sift and sort, and pass on the good engineering material to the higher institutions. In the minds of many the day of the small college has passed. We can say very definitely, however, that where the student is to be closely studied, we must, at least, have small sections.

ELECTRICAL ENGINEERING LABORATORY NOTES.

POLE FACE IRON LOSS TESTING APPARATUS.

BY H. G. HOKE,

Assistant Professor of Electrical Engineering, Washington University.

With the exception of the piece of research apparatus described below, practically all the laboratory equipment of the Department of Electrical Engineering of Washington University is standard, and so needs no description. One feature, however, not commonly found is the provision of marble terminal boards for all apparatus, each board being provided with jacks so that connections may be quickly made by plugs connected to flexible cables.

In the case of two 15-kw. alternators and a 10-kw. rotary converter, the leads from the alternating current terminals of the machines are arranged in a special manner[1] for the purpose of showing at a glance the vectorial arrangement of the several e.m.f.'s.

The special research apparatus referred to above was designed for the purpose of investigating the losses in the pole faces of generators and motors having slotted armature cores. Various formulas for the calculation of these losses have been proposed, but many of them give such conflicting results as to throw doubt upon their accuracy.

The object in designing this particular apparatus was to eliminate all loss except that to be determined, plus the easily measurable friction and windage losses. To that end there has been built an annealed cast-steel homopolar structure having a cross section of E form, with an armature core and

[1] See PROCEEDINGS, Vol. 20, Part 2, p. 366.

spider arranged to rotate in the annular space between the central core and the overhanging lips of the outer shell. Excitation is provided by a coil of heavy strip copper wound on the central core, and designed to give flux densities in the air gap up to about 50,000 lines per square inch. Armature punchings having various shapes of teeth are provided.

The apparatus has been very carefully machined in order to insure a uniform distribution of flux along radial lines all around the air-gap, thereby eliminating iron losses in the rotating armature core. The losses will then consist only of the pole face losses due to the tooth ripple, plus friction and windage; which latter can be readily determined by running the machine without excitation. The rotating armature is mounted on a shaft which extends through the central core, and is supported by ball bearings at each end. The rotor is driven by a suitable adjustable speed motor through a specially constructed torsion dynamometer.

Tests will be made to determine the effect of air-gap flux density, peripheral velocity, and ratio of slot opening to air-gap. The latter variation will be obtained by boring out the annular opening in the casting. After the gap has been sufficiently increased to reduce the losses to a negligible amount, the original solid cast-steel poleface will be replaced by other materials, by fitting in rings of cast iron, laminated sheet steel, etc., and the entire series repeated to determine the losses in these various materials.

DIRECT CURRENT MOTOR-GENERATOR SET FOR LECTURE ROOM DEMONSTRATION.

BY C. C. KNIPMEYER,

Associate Professor of Electrical Engineering, Rose Polytechnic Institute.

A small light-weight and, therefore, readily portable set of direct current machines on a common bed plate and with a

number of portable switchboards is giving good results in connection with lecture work in direct current engineering at the Rose Polytechnic Institute.

The machines, each of 6 amperes capacity at 125 volts, are compound wound and have a removable flexible coupling between them. They are shown in Fig. 1. The series windings have turns enough that the machines may be operated as simple series machines. As compound machines the series coils are provided with various shunts to give any desired degree of compounding.

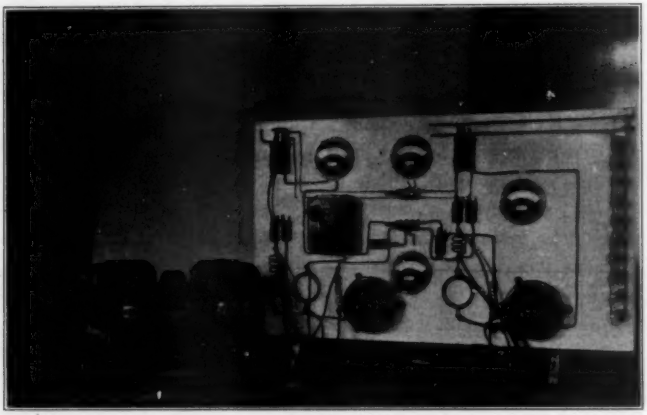


FIG. 1.

In Fig. 1 it will be seen that the actual machine terminals are brought to the switchboard diagrams. The switchboard carries all the wiring, switches, measuring instruments, rheostats and lamp load for the generator. To economize in instruments and give greater experience in switching, a single ammeter is used for both shunt fields.

Saturation tests and variable load tests on separately excited, shunt, series and compound generators are made, while

the magneto, connected to the motor shaft by a rubber tube, serves to indicate the maintenance of constant speed. For torque and load tests on motors, the flexible coupling between the two machines is removed and a Prony brake placed on the motor side of the coupling, the magneto again giving voltage readings for speed. Using the motor as a dynamometer the windage, brush and iron losses of the generator become separable.

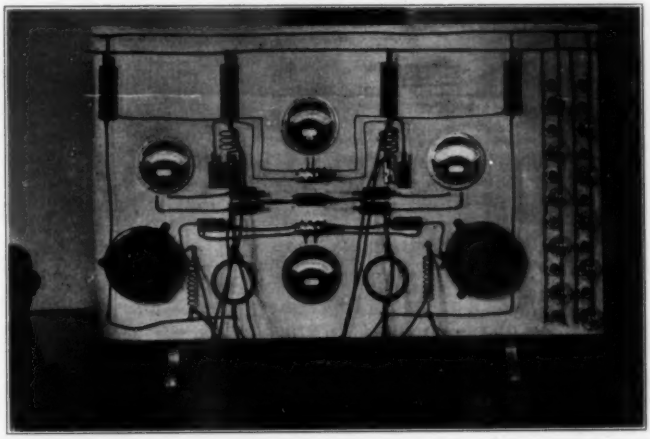


FIG. 2.

Fig. 2 shows the switchboard for parallel operation of generators. In this case the machines are connected together and driven by a third machine with belt over the coupling. A zero-center ammeter in the equalizer would be valuable, although, with the switching indicated, the equalizer current can be obtained without it. The effects of the equalizer and of field rheostat adjustments can be clearly demonstrated. "Loading back" tests can also be made and the interchange of power between the two machines can be made greater than

the power given to the set as indicated by voltmeter and ammeter readings for the motor driving the set.

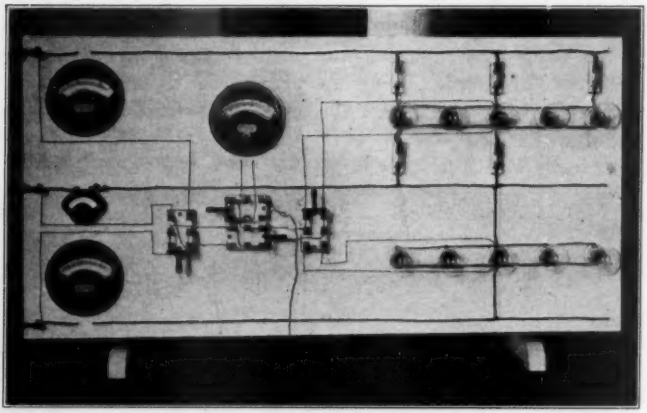


FIG. 3.

Fig. 3 shows a three-wire lighting system supplied through the motor-generator set from a 110-volt two-wire system. One machine, connected across the 110-volt mains, drives the second machine as a generator which then supplies the second half of the three-wire system. The main transmission wires are of No. 22 manganin and have about one ohm resistance, while the wires between the lamp sockets are of No. 24 Excello giving about 0.5 ohm resistance in each wire between sockets. All these wires are run through heavy insulation to make them show up clearly. Using 100-watt carbon lamps the line resistance drops are large enough to be measured. For measuring some of these drops directly the voltmeter is furnished with a second scale reading a maximum of 5 volts. The neutral wire is provided with a zero-center ammeter. The voltmeter wiring and switching allow readings of voltages at generator ends and lamp ends of the lines. The double conductor hanging from the right side of the top switch directly

under the voltmeter is used for getting the voltages at the individual lamps. The five single pole switches control the feeding-in points for the case of the two-wire system, and with them the relative merits of the "loop circuit" and other arrangements are clearly brought out.

In regular laboratory testing the motor generator set is used for motor heat runs, the generator forming a conveniently adjustable load. The small size of the machines results in the ultimate temperature being reached well within three hours, as indicated by the temperature rise curve plotted from frequent shunt field resistance and time observations during the heat run.

The portability of this set is much in its favor.

DISCUSSION OF "ECONOMY IN THE USE OF CLASS ROOM AT LAFAYETTE COLLEGE."

Professor Lyle's study of the "Use of Class Rooms at Lafayette College" contained so many items of interest that it seemed desirable to obtain corresponding results for Lincoln Hall which is used exclusively by the college of civil engineering, Cornell University. When the building was first used in 1889, it also accommodated the college of architecture. For some years after that the students of Sibley College (mechanical and electrical engineering) received their instruction in mechanics, hydraulics, and descriptive geometry in the college of civil engineering. The demand for more room with the increasing number of students led after awhile to the removal of the college of architecture to other quarters, and later to the withdrawal of the Sibley College students who then received their instruction in the subjects named in the buildings of that college.

For over twenty years the preparation of the schedule of rooms, both instructors and students as well as the assignment of rooms, has been made by a committee. In some cases a single recitation room is now used by six or seven classes belonging to three or four different departments. The data given below relate to the first term of the current academic year.

USE OF LINCOLN HALL, CORNELL UNIVERSITY.

Recitation Rooms.	No. of Rooms.	No. of Seats.	Blackboard Area (Sq. Ft.).	Floor Area (Sq. Ft.).	Hours Used per Week.	Student Hours per Week.
Recitation rooms	10	485	2,796	8,003	190	30,625
Drafting rooms	7	337	420	8,189	178	29,430
Engineering laboratory rooms	4		40	4,650	60	3,015
	21	822	3,256	20,842	428	63,070

DISCUSSION OF ECONOMY IN USE OF CLASS ROOMS.

The number of students who use the building is 450, of whom 433 are students in civil engineering. The average number of seats in recitation and drafting rooms per student is 1.83; the average blackboard area per student is 7.24 sq. ft.; and the average area of floor space per student is 46.32 sq. ft.

	Average Use per Week.	Room in Hours per Day.	Maximum Use per Room per Week.	Room in Hour per Day.
Recitation rooms	19.0	3.17	31	5.17
Drafting rooms	21.9	3.65	35	5.83
Engineering laboratories	15.0	2.50	22.5	3.75

Since there is no university instruction on Saturday afternoons it would be more accurate to divide the use per week by 5.5 instead of 6. This would change the average use per day to 3.45, 3.98 and 2.73 hours respectively, and the maximum use per day to 5.64, 6.36, and 4.09 respectively.

The average number of rooms in use daily is as follows:

Monday, 10.25; Tuesday, 11.12; Wednesday, 11.37; Thursday, 12.37; Friday, 11.87; and Saturday, 8.40.

The data given above refers to the use of room which is repeated weekly throughout the term. In addition most of the rooms are used some additional hours, the number of which varies from week to week. For example, when a class is surveying, and can not do field work as scheduled on account of the weather, the class does computing or drawing in one or more rooms. Or a room may be used for a half hour or more in which to give certain instructions just before going into the field for an assigned period. The total number of hours per week in which all the rooms are used in this manner is estimated to be about 43.

HENRY S. JACOBY.

PROGRESS REPORTS OF COMMITTEES.

COMMITTEE ON ADMINISTRATION.

The special work assigned to the Committee on Administration is the investigation of the occupation of engineering teachers during the summer vacation. As a preliminary classification for such an investigation, the following has been kept in mind: (1) The present status of summer employment, (2) opportunities for such employment, (3) fields recommended.

It is at once evident that the data upon which a report can be based must be supplied by the entire membership of the Society and this can be obtained only by the aid of a questionnaire. The work was started on October 7 by a circular letter from the chairman to the members of the committee inviting discussion, and, more particularly, specific lists of questions for the questionnaire. The members of the committee have responded promptly and thoughtfully and the several lists submitted have in turn been circulated and commented upon. The committee is in pretty close agreement as to the kind of information to be sought. It is probable that the field of investigation will not be limited strictly to the three headings mentioned above. It is believed, however, that the questions should be brief and to the point. It is better to get thoughtful answers to a few leading questions than hasty or superficial ones to a formidable list.

It is hoped to get out the questionnaire in January. The real success of the work of this committee (and this is equally true for all of the committees), depends upon the character and promptness with which all of the members of the society respond to the call for data and individual opinion.

F. H. CONSTANT,
Chairman.

COMMITTE ON CIVIL ENGINEERING.

The responses to the questionnaire on surveying and railroad courses, including summer schools, were not received in time to submit a report at the Ames meeting.

However, the data are now tabulated and are being studied with a view to drawing such general conclusions as may seem warranted.

The list of institutions answering the questionnaire is sufficiently large to make an interesting summary, but a number of the larger colleges and universities have not made reply.

As might be expected the data on surveying courses are the most satisfactory, while those relating to railroad courses are less full. The figures regarding summer schools of surveying confirm the impression that comparatively few engineering schools maintain a camp solely for the purposes of instruction in field work, whether it be surveying, railway or geodetic in character. Such data as have been furnished should prove helpful to those members of the Society who may be considering the establishment of such a camp or summer school.

It is expected that the report will be ready for publication in the near future.

W. E. Mott.

COMMITTEE ON ECONOMICS.

Thus far the committee has not been able to do anything worth mentioning, but we are trying to arrange for a meeting at Washington about the end of the year or the beginning of next. The reason for the delay in starting actual work on economics is that two of the four members of the committee are very busily engaged on finishing up the writing of books. They expect to finish the said books early next year. One of the two delinquents is myself.

J. A. L. Waddell.

COMMITTEE ON ENGLISH.

Committee No. 12, English, was asked to consider as its special business for this year the "present status of the teaching of English to engineering students." With the assistance of Dr. C. R. Mann it is gathering such information as is to be obtained from catalogues, and it is sending out, through the office of the secretary of the S. P. E. E., a questionnaire addressed to the various engineering schools of the country.

To get light on certain points from different angles, the committee has asked that in the case of each institution one set of questions be answered by someone competent to speak for the Department of English and a duplicate set be answered by one who can speak for those not teachers of English. The special topics about which inquiry is made are:

1. In what sense is English a "fundamental" subject in the education of engineers?
2. What opportunities are offered for the study of English?
3. What methods of instruction are in practice?
4. What are the aims and the results?

It is the special desire of the committee to get, in as definite form as possible, data that will bring out whatever there may be of individuality in the teaching of English to engineering students in the various schools. It is in no way the intention to publish any criticism or comparison of institutions as such, but to make a study of the general status that will be of interest and of practical service to all concerned.

If everyone interested in the problems of English in engineering education will send to the committee whatever he has to offer that would be of value to others, as to present practice or as to its defects, whether he receives a copy of the questionnaire or not, the report of the committee will undoubtedly be of value.

SAMUEL C. EARLE,
Chairman.

INSTITUTIONAL COMMITTEE.

President Hollis Godfrey, a member of this committee, suggests that a meeting of the Committee of Institutional Delegates, be held at Drexel Institute the first week in February for the purpose of discussing matters of importance to the committee and arranging a program for the next annual meeting of the Society. President Godfrey invites the delegates to be his guests while in Philadelphia.

Secretary Bishop has put up to the committee a peculiar situation and asks for a definition of policy. A regular member of the association represents his institution as a duly appointed delegate. He now claims, therefore, exemption of dues. In order to settle this matter and in order that proper legislation may ensue, it appears to the chairman that the committee should recommend definite answers to the following questions:

1. May institutional delegates be non-members of the Society?
2. If so, shall their names be published in the membership list of the year book?
3. Or, should they be published in a separate list (perhaps with the names of the institutions they represent)?
4. Shall they individually receive the publications of the Society?
5. Should the Society require non-member delegates to pay dues?
6. Shall members who also act as institutional delegates be relieved from paying dues during the time of such delegateship?
7. If dues are not paid will the delegate lose his membership in the Society and have to petition for re-instatement?

In addition to acting on the above, information on the following questions might be collected by the committee:

1. What is the practice of the engineering schools regarding advanced credit for work done in other schools?

2. Can a just and equitable method for grading such credit be devised?

3. What per cent. of institutions pay the whole or part, and what part, of the expenses of the institutional delegate to the annual meeting of the Society?

The chairman would be pleased to have from institutional delegates and others who may be interested, comments on these matters—(1) A meeting of the Institutional Committee at Drexel Institute; (2) the status of institutional delegates per se; (3) answers to the questions submitted; and (4) any other questions deemed appropriate for submission to the committee or which will assist in preparing a program for the next annual session.

GEORGE R. CHATBURN,
Chairman.

COMMITTEE ON MECHANICAL ENGINEERING.

The chairman has prepared a preliminary questionnaire which has been sent to the members of the Committee for their approval. Within the next two weeks we expect to have this questionnaire in the secretary's office for mailing. It is expected that the Committee will be able to report the results of this canvass at the annual meeting in June.

ARTHUR M. GREENE, JR.,
Chairman.

COMMITTEE ON MINING ENGINEERING.

The Committee on Mining Engineering has under consideration a list of questions to be submitted to the mining schools. It is expected that the list will be completed to the satisfaction of the committee at an early date.

Respectfully,

F. W. SPERR,
Chairman.

COMMITTEE ON PHYSICS.

The committee expects to ask that two questionnaires be sent out: one to teachers of physics in engineering schools and to teachers in some of the principal academic institutions. The other to be sent to a large list of practicing engineers. These questionnaires would cover the subjects in connection with physics, as mentioned in the report of the committee made at the Ames meeting.

DAYTON C. MILLER,
Chairman.

COMMITTEE ON THE STANDARDIZATION OF TECHNICAL NOMENCLATURE.

The Committee on Standardization of Technical Nomenclature presented a preliminary report at the June meeting, 1915. Mimeographed copies of this report have been sent to a number of engineers and teachers in this country and criticisms of the preliminary report, new terms to be considered and suggestions for the next report have been received from about fifty members of the society. Altogether, a very interesting body of data has been accumulated. The committee has been awaiting the publication of the preliminary report, either in the BULLETIN or in the PROCEEDINGS, in the belief that other suggestions or criticisms might be inspired by the appearance of the report.

When a reasonable time has elapsed after the appearance of the preliminary report in print, all of the matter that has been collected on the subject will be analyzed and another report prepared. The committee wishes to express its thanks for the kind coöperation of many of the members, who have given much time and thought to a consideration of the preliminary report.

JOHN T. FAIG,
Chairman.

COMMITTEE ON STATISTICS.

The Committee on Statistics of Engineering Education has before it a number of questions, the most important being the following which were submitted at the two last annual meetings:

1. What is the comparative scholarship of students entering engineering schools (*a*) from the Latin and English high schools and their equivalents and (*b*) from the manual training, technical, and vocational high schools of the large cities?

2. What record of attendance and mortality of students, and location and occupation of alumni is kept by institutions in which engineering courses are given?

3. What statistical studies have been made or are being made of students' scholarship records, either by institutions or by members of the faculties?

4. What other work along the line of statistical studies is being undertaken by engineering schools?

5. From what institutions should information, which is desired by the Society, be secured?

The first of the above questions is of special significance, requiring more than merely the collection of data. Such points as the following have been raised: Can scholarship be composed on grades, independent of the subjects, the instructors or the courses? Over what period of time should the record or grades be considered? To what extent does the personality of instructors affect high or low grades?

The Committee is carefully analyzing the conditions under which a fair conclusion may be drawn, before proceeding to collect a mass of data which is not definite in its bearing. Some valuable opinions have been gathered by the Committee and many of them are based on years of experience and on trustworthy records. The Committee aims to throw some new light on this important question.

Suggestions on the above or on questions which should be considered by this Committee will be appreciated.

A. J. WOOD.